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## GEOMETRY.

293 (Incorrectly numbered 290). Proposed by FRANCIS RUST, C. E., Allegheny, Pa.

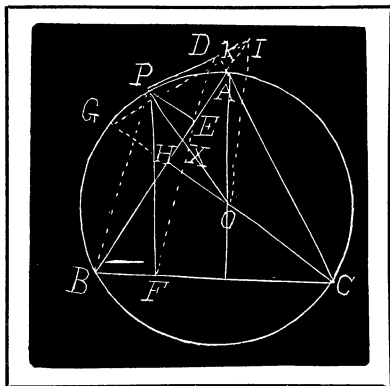
The pedal line of any point on a triangle's circum-circle bisects the distance between this point and the ortho-center of the triangle.

I. Solution by G. W. GREENWOOD, M. A., Dunbar, Pa.

Take, for convenience, an acute triangle  $ABC$  and the point  $P$  on the arc  $BC$ , the feet of the perpendiculars upon  $BC$  and  $CA$  being  $D$  and  $E$ , respectively.  $P$  is not supposed coincident with  $B$  or  $C$ . Call the orthocenter  $O$ , and let  $BO$  cut the circle again in  $G$ ; let  $PQ$  intersect  $DE$  in  $H$  and  $AC$  in  $F$ . Basing the demonstration mainly upon pictorial evidence, we have, since the quadrilateral  $PDEC$  is cyclic,  $\angle PED = \angle PCD = \angle PGB = \angle GPE$ . Hence the triangle  $PHE$  is isosceles, and therefore  $HEF$  is isosceles, and also  $PH = HF$ . It can easily be shown that  $OG$  is bisected by  $AC$ . Hence  $\angle OFA = \angle GFA = \angle HFE = \angle HEF$ . Hence  $DE$  bisects  $PF$  and is parallel to  $OF$ . It therefore bisects  $PO$ .

II. Solution by J. SCHEFFER, A. M., Hagerstown, Md.

Let  $P$  be a point in the circumference of the circle, and  $PD, PE, PF$  be the perpendiculars let fall from  $P$  upon the three sides of  $\triangle ABC$ , the straight line  $DEF$  is the pedal for the point  $P$ . Let  $O$  be the orthocenter, and draw  $OH$  perpendicular  $AB$  and extend it to  $G$ ; join  $G$  with  $P$  and produce it until it meets the pedal  $DEF$  at  $K$  and the side  $AB$  produced at  $I$ ; draw  $PB$  and  $IO$ . We now have  $\angle PED = \angle PAD = \angle PBC = \angle PGH = \angle IPE$ ,  $PE$  being parallel to  $GH$ ; hence  $\angle KEI = \angle KIE$ , being the complements of the equal angles  $IPE$  and  $PED$ ; therefore  $PK = KE = IK$ . But  $\angle HIO = \angle GIH = \angle DEI$ . Therefore  $DX$  is parallel to  $IO$ ,  $X$  being the point of intersection of  $PO$  and the pedal  $DEF$ . Since  $K$  is the middle point of  $PI$ ,  $X$  must be the middle point of  $PO$ . Q. E. D.



294 (Incorrectly numbered 292). Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Apply the locus of  $(x^2 + y^2)^3 = mx^3$  to the problem of finding a cube  $m$  times a given cube.

[No solution has been received.]

295. Proposed by W. J. GREENSTREET, M. A., Editor Mathematical Gazette, Stroud, England.

A variable circle touches an ellipse, and the chord of contact through the other two points of intersection touches a similar coaxial ellipse. Find the locus of the center of the variable circle.